A CAUSE OF FEUD BETWEEN ANTS OF THE SAME SPECIES LIVING IN DIFFERENT COMMUNITIES.

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If the blood of several ants of the same species be shed upon a morsel of sponge, the characteristic odor of the species is discernible upon the sponge, even by human nostrils. The odor may be pungent, acid, acrid, or musty, or may be like that of an animal or vegetable oil. Of the thirty-five hundred known species of ants, probably each has its distinctive odor.

Every ant recognizes its acquaintances through their odor and its own sense of smell. It is violently hostile to all ants bearing an unfamiliar scent, and is caressingly friendly with ants whose odor it has always known.

That ants of unlike species should be inimical one to another is less strange than the fact that those of the same species and variety, inhabiting the same localities, but living in different communities, should be as intensely antipathetic as are those of different species. With a view to ascertaining the cause of the animosity between such communities, I made in 1902, many experiments[1] with *Stenamma fulvum*, with results showing that the odor of the ants changes with their age, and that ants will not live amicably with those much older than any that inhabited the nest in which they were hatched.

If an ant be hatched in isolation, and the isolation be maintained until the ant has attained its adult strength and color, the odor of its own body is this ant's sole criterion of proper ant-odor, and it will affiliate with no ants other than those of the same lineage and of nearly the same age as itself. It will affiliate instantly with the queen-mother from whose egg it came and whose odor it inherits, and will identify and caress that mother though she be presented among five queens never before en-

[1] A. M. Fielde, "Notes on an Ant," *Proceedings of the Academy of Sciences of Philadelphia*, December, 1902.

countered. It will also affiliate with any of her progeny of the same age as itself, or with the progeny of her own sister of the same age.

A difference of forty days in the ages of two ants produces a difference of odor appreciable by the ants. If many pupæ be taken from one colony, and the workers hatched therefrom on the same day be segregated; and then, later on, more pupæ be taken from the same colony and the workers hatched therefrom on the same day be likewise segregated and established in a nest with inert young, the younger group of ants will not permit the members of the older group to approach the young in their nest, provided always that there be forty days or more of difference in the age of the two groups. The degree of animosity exhibited is in direct ratio to the difference in the age.

An ant hatched in the first brood of a solitary queen associates during its earliest days only with its queen and with its sister-ants, all hatched in one summer. These workers know only ants that are less than a year old, and will never become acquainted in a friendly converse with ants older than themselves. As seasons pass, and more ants are annually hatched from the eggs of this queen or the queens among her offspring, the latest comers know the odors of those of their own year, and of each year gone by, up to that of the oldest in the common nest. One might say that the sense of smell in the ant is more highly cultivated if she live in an old community.

I have been personally acquainted for four years with the ants in a community, the C colony, whose domain is a hundred yards in its diameter. On August 22, 1901, I took queens, males and workers from the wild nest of this colony, and segregated a similar group in each of two Fielde nests, where I kept them two years. The queens were winged when captured, and were doubtless less than a month old. The workers were fully colored, and may have been a year or more older than the queens. No young was permitted to hatch in either nest, and there was no communication between the two nests nor with outside ants. On August 25, 1903, I united the two groups, then numbering four queens and twenty-five workers in one nest, and two queens and nineteen workers in the other nest. They all affiliated in-

stantly with no sign of cognizance of their long separation. They had added years simultaneously and there was no difference of odor to occasion distrust among them.

I then introduced into the nest of the two united groups several very young ants taken that day from the wild nest. These callows were kindly received because the old ants all recognized an ant-odor with which they had formerly been acquainted, and this recognition was instant notwithstanding the fact that they had met no callows during two years. It is probable that an ant remembers during its lifetime any odor with which it has once been acquainted.

I then brought queens and workers from the same wild nest, housed them with their inert young in one of my artificial nests and left them to establish their nest-odor. A few days later I introduced into their nest marked queens and workers from the groups segregated two years previously. The marked queens were instantly accepted by the queens and workers in the latest nest. The marked workers were amicably received by all the queens, and by most of the workers in the latest nest, while a few nabbed them or dragged them away from the pupæ-pile. They were not killed but were denied by these few, the crowning mark of ant-esteem, permission to share in the care of the young. It thus appeared that ants as old as were these sequestered workers were not common in the summer of 1903 in the wild nest of the C colony, while queens two years old were known to all the ants taken from the wild nest.

Difference of food, drink and environment during two years had not caused a difference of ant-odor between the segregated ants and their ancient comrades.

The progeny of queens of unlike age but of the same community are unlike in odor.

Four queens of the C colony, captured by me before their swarming and while they were still winged, on August 22, 1901, were segregated with kings of their own colony in one of my nests which I here refer to as Section A. Two queens of the same colony hatched on August 5, 1902, from pupæ taken from the wild nest two days earlier. They mated with kings of their own colony on August 22, 1902, and were later on segregated

with workers hatched in my artificial nests between August 8 and 28, 1902, from C colony pupæ. This nest I here refer to as Section B.

The ants in the two sections were fed with the same kinds of food on the same days and had in all respects similar environment.

On July 12, 1903, an ant-worker hatched from a pupa that had been previously removed from Section B, and isolated in a Petri cell. This worker was kept in isolation until she was six days old. I then introduced into her cell a worker, the offspring of a queen in section A, and she attacked this worker with great violence, although the worker was of an age precisely her own and had likewise been isolated from the pupa-stage. The only difference between the two lay in the age of their respective mothers, one queen mother being two years old and the other one year old. Neither of these callows had, previous to their meeting, ever smelled any other ant, and had they had the same odor they would have affiliated, as do similarly reared ants that are the progeny of the same queen or of sister queens.

On August 24, 1903, when the ant from Section A, used in the foregoing experiment, was forty-three days old and was occupied in the care of introduced larvæ, I put into her Petri-cell, where she had always lived alone, a callow five days old, reared in isolation from a pupa taken from Section B. The resident ant at once attacked and dragged the callow. In this case the offspring of the older queen attacked the offspring of the younger queen, though that offspring was much younger than herself.

Other experiments coincided in their results with the two here recorded.

A cause of feud between ants of the same species living in different communities is a difference of odor arising out of difference of age in the queens whose progeny constitutes the communities, and difference of age in the ants composing the community.

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